higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T670(**E**)(A3)T

NATIONAL CERTIFICATE

FAULT FINDING AND PROTECTIVE DEVICES N5

(8080115)

3 April 2018 (X-Paper)
09:00–12:00

This question paper consists of 5 pages and 1 formula sheet.

Copyright reserved

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
FAULT FINDING AND PROTECTIVE DEVICES N5
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Write neatly and legibly.

Copyright reserved

QUESTI ON 1

1.1 List SEVEN steps to follow when designing a motor control circuit. (7)

1.2 All electrical installations must be protected against faults caused by overcurrent, overload and faulty equipment.

Name any THREE protective devices used to protect a circuit from faulty conditions. (3)

[10]

QUESTION 2

2.1 Name TWO types of rotors used in three-phase induction motors. (2)

2.2 Explain the term *bedding* of brushes. (2)

2.3 State any FOUR rules to follow before working on dead apparatus. (4)

2.4 Explain the main purpose of the locked rotor test in electrical machines. (2)

[10]

QUESTION 3

FIGURE 1 shows the back-to-back test for DC shunt machines.

Copy the sketch in the ANSWER BOOK and place the correct component in each empty circle.

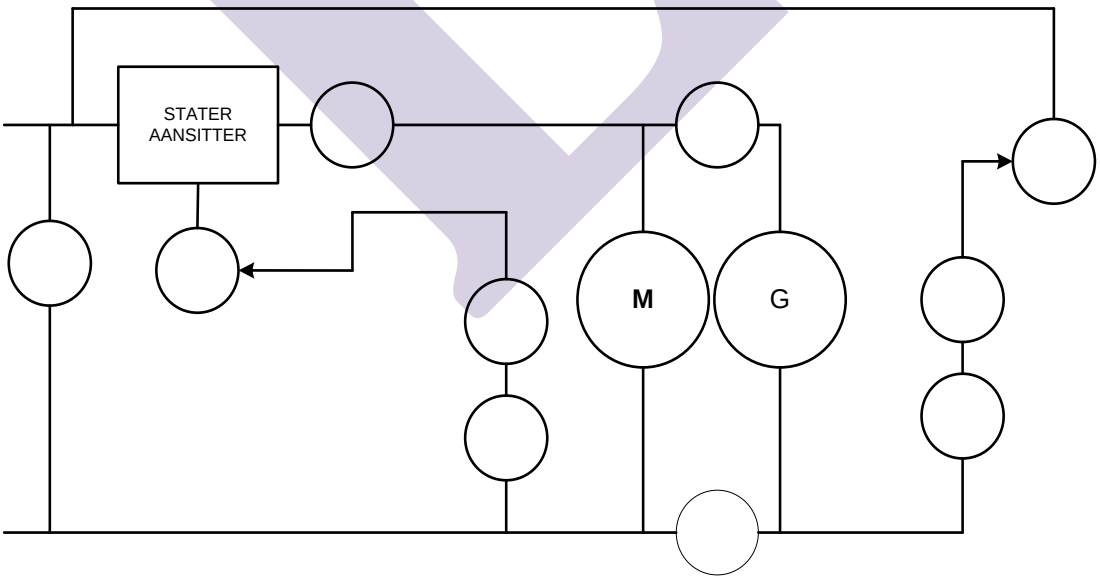


FIGURE 1

[10]

QUESTION 4

4.1 State FOUR faults that may be detected with an induction test. (4)

4.2 Three-phase motors can operate in star or delta connection.

State THREE advantages and TWO disadvantages of starting a motor in star connection. (5)

4.3 Explain what is meant by *plugging* in three-phase induction motors. (1)
[10]

QUESTION 5

Draw a block diagram of a digital voltmeter. **[10]**

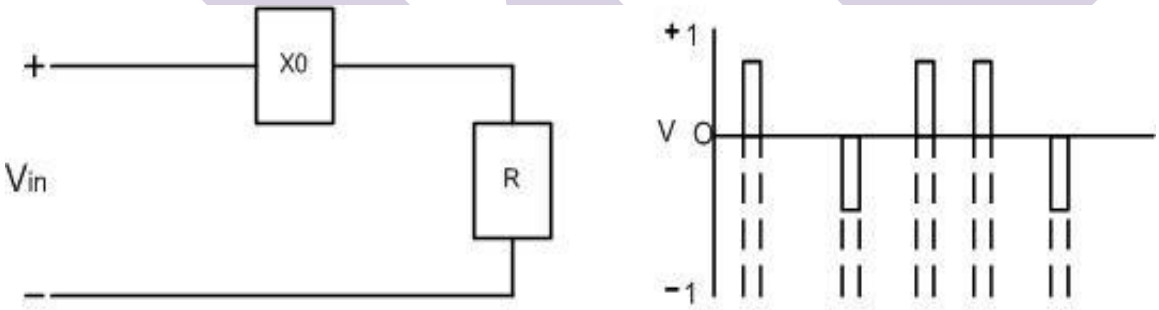
QUESTION 6

6.1 Name any FIVE tests carried out on AC motors before assembly. (5)

6.2 Name any FIVE tests carried out on DC motors before assembly. (5)
[10]

QUESTION 7

7.1 XO is represented by different components in FIGURE 2 below.



Input wave

FIGURE 2

Copy the input wave in the ANSWER BOOK and draw the output wave represented by each component beneath the input wave of the following:

7.1.1 SCR

7.1.2 GTO

7.1.3 Transistor (PNP)

(3 × 2) (6)

7.2 State FOUR applications of negative feedback. (4)
[10]

QUESTION 8

8.1 Draw the truth table of each of the following flip-flops:

8.1.1 R-S flip-flop

8.1.2 J-K flip-flops

(2 × 4) (8)

8.2 How are flip-flops used in binary counters? (2)

[10]

QUESTION 9

9.1 Draw the IEC symbol for each of the following:

9.1.1 Two-input NOR gate

9.1.2 Two-input AND gate

9.1.3 Two-input XOR gate

(3 × 2) (6)

9.2 Draw the electrical circuit of an AND gate and an OR gate function by using TWO switches. (2 × 2) (4)

[10]

QUESTION 10

Convert the following numbers to the base shown in brackets:

10.1 121_{10} (2)

10.2 $76B_{16}$ (2)

10.3 $1000\ 001{,}011_2$ (10)

10.4 $2D9_{16}$ (10)

10.5 001010110111_2 (8)

(5 × 2) **[10]**

TOTAL: 100

Copyright reserved

FORMULA SHEET

FAULT FINDING AND PROTECTIVE DEVICES N5

$$\frac{R_a}{R_2} = \frac{(1 + \alpha\ cu\ ta)}{(1 + \alpha\ cu\ t_2)}$$

	Ra =	*Resistance of motor windings at ambient temperature before test in ohms*
	∀cu =	*Temperature coefficient of resistance of copper (0,004)*
	Ta =	*Ambient temperature in °C*
	R_2 =	*Resistance of hot windings after test in ohms*
	t_2 =	*Temperature of hot windings after test in °C*

P = VI Cos ø

	P =	*Power in watts in single-phase AC circuit*
	V =	*Applied voltage in volts*
	I =	*Current in circuit in amperes*
	Cos ø =	*Power factor* *Cosine of phase angle between applied voltage and current*
Electron charge	*E* =	$1{,}602 \times 10^{-19}$ *coulombs*
Mass of electron	*Me* =	$9{,}11 \times 10^{-31}$ *kg*
Mass of proton	*Mp* =	$1{,}673 \times 10^{-27}$
Heat energy due to friction between shaft journal and bearing	*Eμ* =	*Tμ* $\times 2\pi u$ *Joule per second*
	u =	*Revolutions per second*
	Tμ =	*Friction torque in Nm*
	Tμ =	*μ* × *P* × *R*
	μ =	*Coefficient of friction*
	P =	*Normal load on bearing in Newton*
	R =	$\frac{D}{2}$ *in metres*
	D =	*Journal diameter in metres*

Copyright reserved